Cellular Dynamics

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UNPUBLISHED PRELIMINARY DATA

The AIBS Interdisciplinary Conference Program held its Second Conference on Cellular Dynamics at the Nassau Inn, Princeton, N.J., February 9-12, 1964. This Conference was supported under a contract from the National Aeronautics and Space Administration. A preceding meeting on intracellular movements had been held at the same location, February 10-13, 1963. At that time a decision was taken to convene a Second Conference with cell surface interactions as the subject for discussion.

Murray D. Rosenberg (Rockefeller Inst.) [1964] 4p onefa 2d Conf. on Cellular Dyn. held at Princeton, N. J., 9-12 Feb. 1964

This Second Conference was attended by the following persons: Murray D. Rosenberg, The Rockefeller Institute, New York, Chairman; Michael Abercrombie, University College London, England; William Bloom, University of Chicago Medical School; John T. Bonner, Princeton University; Arthur L. Colwin, Queens College - City of New York; James F. Danielli, State University of New York at Buffalo; Gerald C. Easty, Chester Beatty Research Institute, London, England; James E. Gavin, Northwestern University Medical School; Gunther Gerisch, Albert-Ludwig University, Freiburg um Bresgau, Germany; Arthur McLaren, University of California, Berkeley; Aaron Moscona, University of Chicago; Lee D. Peachey, Columbia University; Peter Perlmann, University of Stockholm; John Preer, University of Pennsylvania; David Robertson, McLean Hospital; Nelson T. Spratt, University of Minnesota; Malcolm Steinberg, John Hopkins University; A. Cecil Taylor, The Rockefeller Institute; Edward W. Taylor, University of Chicago; Thomas E. Thompson, Johns Hopkins University; and Frank Fremont-Smith, Director AIBS Interdisciplinary Conference Program.

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With this multidisciplinary group an attempt was made, through discussion in depth, to integrate the physical, chemical, and biological data which bear upon the problem of cell surface interactions. The program included the following subjects and discussion leaders: the physical chemistry of interfaces, Dr. Thompson; the structure of membranes, Dr. Easty; interactions between cell surfaces and solid substrata, Dr. Garvin; cell-cell interactions, Dr. Abercrombie; surface-active enzymatic reactions, Dr. McLaren; localization of antigens at surfaces, Dr. Perlmann.

Motion picture films portraying special aspects of surface interactions were presented by Drs. A.C. Taylor, Moscona, and Gerisch. In addition each participant was given ample opportunity at all times to present illustrative material pertaining to the topic under consideration. Since the Conference was based upon continuous discussion and interchange of information rather than formal presentations, it is difficult to detail all of the areas covered. A full transcription of the meeting, after editing by the participants and scientific editor, Dr. Lee D. Peachey, will be published and will convey far beyond this brief memorandum the stimulating atmosphere of free scientific exchange that prevailed.

At the onset of the meeting attention was focused on the physical and chemical properties of synthetic bimolecular and unimolecular membranes and their relevance to biological structures. Several estimates were made of the intermolecular forces that stabilize such systems, especially double leaflets of phospholipids, and correlations were sought between these physical forces, the assumed structure of membranes, and physical properties such as permeability, capacitance and water content. These discussions led to a subject of special interest, the ability of

biological surfaces to undergo plications and expansions. No quantitative relationship could be established, for example, between the marked degrees of expansion which most cell membranes can undergo in vitro, especially during active pinocytosis, and the amount of endoplasmic reticulum or the estimated change in area of bimolecular leaflets with reorientation of their constituent molecules. This subject was followed by an exploration of current data and possible future experiments that might be used to investigate the problem.

Discussion then turned to the microdifferentiation of cell surfaces and the nature of macromolecular coats that overlie cell membranes. Studies on virus hemagglutination, phosphatase activity and the mechanical properties of surfaces were reported on. Special attention was placed on the roles of mucopolysaccharides and enzymatic proteins that can be detected at surfaces of cells, and the degree of heterogeneity of cell surfaces. These materials were looked upon from several viewpoints; as coacervates which can undergo phase transitions under the influence of cations, as cation-and trace-metal-sensitive enzymatic systems, and as chelating agents.

There was considerable interest in the facts that the interaction between leucocytes and certain solid substrata is primarily magnesium sensitive while for some other cell types calcium appears to play the more significant role, and that suppression of oxidative phosphorylation inhibits cell-glass adhesiveness in cellular slime molds but has no effect on cell-cell interactions. Of equal interest was the observation that the surfaces of sponge cells are covered with removable PAS-positive mucopolysaccharide coats that are highly specific in cell surface interactions.

Further discussion included reports on the role of contact inhibition in cell surface interaction and considerable speculation regarding the mechanisms that underlie this and several other phenomena such as the movements of surfaces, the ruffling of surfaces, and formation of microprojections and microspikes as have been observed for many cell types under suitable conditions. The part played by these processes in cell aggregation and tissue formation was discussed. It was not possible to correlate the known properties of surfaces, the observed dynamics of individual cells and the behavior of large aggregates or groups of cells. Some evidence was presented to illustrate how the behavior of groups of cells can at times be characterized in terms of phenomenological variables applicable to the group rather than in terms of the properties of individual cells.

On the final day of the Conference the participants examined highly specific forms of cell surface interactions such as fertilization which is accompanied by fusion of membranes, and the aggregation of certain cellular slime molds. Attention was again placed on some highly specific physico-chemical phenomena which might clarify the specificity of cell surface interaction. These phenomena included surface-active enzymatic reactions, the microtitration of hydrogen ion concentration by surfaces in motion, and the roles of specific antigenic sites that are detectable on the surfaces of sea urchin eggs. Although no final conclusions could be reached as to the relative significance of these and other processes, some observable and others presumptive, an attempt was made at all times to reach reasonable judgments based on the physical, chemical, and biological knowledge available to the participants.

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